REMARKS

This Preliminary Amendment cancels original claims 1 to 8 in the underlying PCT Application No. PCT/DE03/00561 and adds new claims 9-16. The new claims conform the claims to the U.S. Patent and Trademark Office rules and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.125, the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including the Title and Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. § 1.121 and § 1.125, a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. In the Marked Up Version, underlining indicates added text and "strike-throughs" and double-brackets indicate deleted text. Approval and entry of the Substitute Specification (including Abstract) are respectfully requested.

Also enclosed is a translated copy of the International Search Report dated September 10, 2003. The Search Report includes a list of documents that were considered by the Examiner in the underlying PCT application.

It is asserted that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully Submitted,
KENYON & KENYON

Dated: 2/14/2005

By: [signature] Reg. No. 37,865 Aaron C. Deditch

Richard L. Mayer
Reg. No. 22,490

One Broadway
New York, New York 10004
Telephone: (212) 425-7200

CUSTOMER NO. 26646

DEVICE FOR IMPACT SENSING

~~Background Information~~

FIELD OF THE INVENTION

The present invention ~~is directed~~relates to a device for impact sensing~~ according to the definition of the species in the independent claim~~.

BACKGROUND INFORMATION

~~From~~ German ~~patent application DE~~Patent Application No. 102 10 131.0 (not a prior publication) ~~it is known to communicate~~refers to a communication of pressure data from a pressure sensor to a control unit as differential values or absolute values.

~~Advantages of the Invention~~

SUMMARY OF THE INVENTION

The ~~device according to the~~ present invention may provide an exemplary device for impact sensing~~ having the features of the independent claim has the advantage over the related art that~~, which communicates normalized pressure values ~~are now communicated. This ensures~~to ensure that the pressure signal is independent of the ambient pressure, and ~~makes~~may make simple and inexpensive performance of the signal analysis in the central control unit~~ possible~~. Furthermore, by shifting of the signal processing, better performance in the control unit may be expected. ~~Finally~~Also, normalization of the pressure data ~~provides the~~may provide a prerequisite for enabling the normalized pressure data to be compatible with the signals from acceleration sensors.

EV323019431

~~Through the measures and refinements set forth in the subclaims, advantageous improvements on~~An exemplary embodiment and/or exemplary method of the present invention may provide an improved the device for impact sensing in a vehicle ~~specified in the independent claim are possible~~.

~~It is particularly advantageous that~~According to an exemplary embodiment and/or exemplary method of the present invention, the signal ~~is~~may be normalized to the ambient pressure~~. This ambient pressure~~, which may be detected by an additional sensor or it may already be stored in a memory, or the sensor element, i.e., in particular a micromechanical sensor element, ~~is designed~~may be configured so that it already outputs a normalized ambient pressure as the measured value. If an ~~additional~~another sensor is provided ~~besides~~in addition to the pressure sensor for impact sensing, then this additional sensor ~~should advantageously~~may be used to register the ambient pressure outside of ~~the~~a largely enclosed element in which the pressure sensor for impact sensing is located. The pressure sensor for impact sensing ~~works~~may work according to the principle of registering an adiabatic pressure increase that occurs because of a deformation of a vehicle part.

~~Drawing~~

~~An exemplary embodiment of the present invention is illustrated in the drawing and explained in greater detail in the following description.~~

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block diagram of ~~the~~an exemplary device according to the present invention~~, and~~.

Figure 2 shows a flow chart of the sequence of operations on the processor of the exemplary device according to the present invention.

~~Description of the Exemplary Embodiment~~

DETAILED DESCRIPTION

Pressure sensors ~~are known from~~may be used in industry and ~~from~~ automotive applications. Depending on the ~~design~~configuration, these may transmit absolute or differential pressure values. In the case of the automobile, along with engine control, the pressure sensors ~~are~~may also ~~being~~be used ~~more and more~~ for sensing side impacts.

According to an exemplary embodiment and/or exemplary method of the present invention, ~~provision is now made for~~ the pressure signal ~~to~~may be normalized so as to simplify further processing. ~~This results in the advantages that~~Consequently, the pressure signal for the airbag triggering ~~algorithm is~~procedure may be independent of the ambient pressure and ~~that~~ the signal processing in the central control unit may be kept simple and inexpensive. If this preprocessing is shifted to the relocated pressure sensors due to the normalization, better performance in the central control unit may be expected. In particular, normalization may also ~~makes~~ensure the compatibility of the signals from the pressure and acceleration sensors ~~possible~~.

Pressure sensors ~~are finding increasing use~~may be used in modern restraint systems for measuring the deformation of the side doors in the event of a side impact. This ~~is~~may be accomplished via an adiabatic pressure increase, which ~~makes especially~~may provide quick sensing of a side impact ~~possible~~. Triggering times of a few milliseconds ~~are possible~~may also be provided here. For the pressure sensor, the useful signal in the case of an impact is in a first approximation proportional to the ambient pressure, i.e., as a function of the altitude at which the vehicle is being operated, as well as of the current weather situation. In order for these influence variables not to be taken into account in the triggering ~~algorithm~~procedure, the pressure signals are reprocessed appropriately. This may be carried out either in the sensor itself or in the control unit. In certain cases, by ~~designing~~configuring the sensor element appropriately it ~~is~~may even be possible to map the signal processing, which in some

circumstances may be ~~an extremely~~a cost-effective approach. The goal is to transmit a value such as:

$$P_{N1} = S \cdot \frac{(P - P_0)}{P_0}$$

or

$$P_{N2} = S \cdot \frac{P}{P_0}$$

where S is the scaling factor, P is the currently measured absolute pressure in the interior of the door and P_0 is the absolute ambient pressure. ~~The advantage for~~A feature of the ~~algorithm~~procedure or the control unit, in addition to the non-dependency of the crash signal on the ambient pressure, is ~~primarily~~ that the measure illustrated ~~makes~~may make it possible for the pressure to be compatible with acceleration sensors that were formerly used exclusively.

Figure 1 shows a block diagram of ~~the~~an exemplary device according to the present invention. A sensing element or sensor element 1, for example a micromechanical diaphragm, acts here as a pressure-measuring element. The signal which is emitted by sensor element 1 is amplified by an amplifier 2, and is then passed to an analog-digital converter 3 to be digitized. The digitized signal is then passed to a signal preprocessor 4, which then passes the preprocessed signal to a transmitter module 5. Transmitter module 5 transmits the filtered signal via a line 6 to a control unit, namely to a receiving module 7. Receiving module 7 then passes the received signal to a processor 8, which employs a memory 9 to use the pressure signal via a data input/output for a triggering ~~algorithm~~procedure for restraining devices. As a function of the analysis of this triggering ~~algorithm~~procedure, a restraining ~~means~~arrangement 10, for example an airbag or belt tensioner, is then activated. Hence the pressure sensor is made up of sensor element 1, amplifier

2, analog-digital converter 3, signal preprocessor 4 and transmitter module 5. These elements are housed in an enclosure and located in the side part of a vehicle, in order to measure an adiabatic pressure increase in the event of a side impact. The pressure sensor acts then as an indirect deformation sensor. Only one pressure sensor is shown here as an example, but it ~~is usually~~may be the case that at least two pressure sensors are located on opposite sides of the vehicle, or for example even four, in order to monitor all doors of a four-door vehicle, for example. The pressure sensor in this case ~~must~~may be required to be located ~~in particular~~ in a largely enclosed part of the vehicle, so that there may be an adiabatic pressure increase.

Alternatively, ~~it is also possible for~~ such a pressure sensor ~~to~~may be placed in other parts of the vehicle, in order to detect a front impact, an offset impact, or a rear impact, for example. It ~~is~~may be important here for an adiabatic pressure increase to be possible in order to enable quick sensing through the pressure increase. Receiving module 7, processor 8, and memory 9 are located in the control unit, which may be ~~situated~~arranged, for example, on the vehicle tunnel, but they may also be located in the pressure sensor itself. Adjacent to it there may also be other components, including ~~in particular~~ a connection to an acceleration sensor as a plausibility sensor. The acceleration sensor itself may also be positioned in immediate proximity to processor 8. Instead of an acceleration sensor, other sensor types such as structure-borne sound detectors or deformation sensors may also act as plausibility sensors. Only if this plausibility sensor also signals an impact is processor 8 able to activate restraining ~~means~~arrangement 10. If the control unit is positioned centrally in the vehicle, then line 6 takes the form a two-wire line here. A unidirectional connection from the pressure

sensor to the control unit is provided here in particular. In this case a direct current is put on line 6 by the control unit, in order to supply the pressure sensor with the necessary power. To transmit data, the pressure sensor impresses the measuring signal in the form of current fluctuations, i.e., by ~~means of~~ amplitude modulation, so that receiving module 7 receives the pressure signal through these current fluctuations. ~~It is also possible to provide for pulse~~Pulse width modulation may also be provided instead of amplitude modulation.

Alternatively, ~~it is also possible to provide~~ a bidirectional connection may be provided on line 6, i.e. one where the control unit is able to transmit queries to the pressure sensor. ~~Another alternative is~~Alternatively, a sensor bus may be provided. The pressure sensors and also the control unit may be connected to this sensor bus, as shown in Figure 1. To that end, the connected sensors and the control unit have bus controllers, in order to make data traffic via the bus possible. Such a bus ~~is of benefit in particular~~may be desired where there are a plurality of sensors, in order to reduce cable costs.

Normalization is carried out either by sensor element 1 itself or in signal preprocessor 4, which performs the division of the measured pressure by the ambient pressure, or by processor 8, which ultimately uses the measured value from the pressure sensor to perform the division only in the control unit. ~~These~~Hence, at least three options ~~are~~may be available ~~in principle to be chosen~~. If normalization is achieved by sensor element 1 itself, then it ~~is~~may be possible, for example, to provide a hole in the pressure sensor diaphragm.

Figure 2 illustrates the sequence of ~~the process~~an exemplary method which is given by the exemplary device. In method step

11 the pressure signal is produced by components 1 through 5 of the pressure sensor, as indicated above. Normalization of the pressure signal may be performed already here by sensor element 1 or by signal preprocessor 4. In method step 12, transmitter module 5 transmits the pressure signal or the normalized pressure signal to the control unit, namely receiving module 7. In method step 13, processor 8 receives the normalized or non-normalized pressure signal, and performs normalization if appropriate. In method step 14, processor 8 uses memory 9 to execute the triggering ~~algorithm~~procedure, a plausibility signal, ~~preferably~~which may be taken, for example, from an acceleration sensor, being taken into account. Only if the pressure signal and the plausibility signal indicate an impact does processor 8 recognize an impact in the triggering ~~algorithm~~procedure, and the system jumps to method step 15 to activate restraining ~~means~~arrangement 10. Parameters such as occupant monitoring and classification ~~are~~may also be taken into account when activating restraining ~~means~~arrangement 10. If no impact was detected in method step 14, then the system jumps back to method step ~~11.~~11

ABSTRACT

~~Abstract~~

A device for impact sensing is described which detects an impact by ~~means of~~ a pressure, a normalized signal being supplied to a processor for analyzing the pressure signal. This normalization ~~takes place~~may occur either in the pressure sensor, by the sensor element ~~(1)~~ itself or by a signal preprocessor ~~(4)~~, or ~~it takes place~~ in the processor ~~(8)~~.

~~(Figure 1)~~